

Manual && Reproduction Report for

Watch and Act: Multi-orientation Open-set Scene Text Recognition via Dynamic Expert Routing

Hardware requirements

GPU:

Testing: NVIDIA GPU with Turing or later structure and more than 4 Gib of vram.

(yes pascals, maxwells or even fermis may work, but you gonna need to know what you are doing)

Training: 24GiB GPU with Turing or later structure for regular model

(In theory 16GiB ones work too but I am not promising that.)

CPU: X86 cpus with AVX2 instruction set

(CPUs without AVX2 may or may not work with different version of torch, I don't know)

RAM: 16GiB (Testing) 32Gib (Training)

Disk: 500GiB (well just dig out one old hdd from your bucket, or ebay and that's it)

Internet: Yes

Software Requirements

1. Fresh installed Archlinux with these packages:

`sudo vim plasma-meta nvidia openssh firefox dolphin konsole wget git less`

2. The user name is set to lasercat and it has to be a sudoer (or you may need to go thorough the code to replace paths if something went south).

3. ***Keep important data off this device!***

I don't want to wipe your data due to one or two failed cd commands followed by mv and/or rm

Trivia: Manul, aka the Pallas' cat, is the oldest cat specie still alive on the earth.



Environment setup

1. install the following packages once you boot in.

```
sudo pacman -Syu pycharm-community-edition plasma-meta python-paramiko python-lmdb  
python-numba python-opencv python-pillow python-pip python-pyqtgraph python-pytorch-opt-  
cuda python-regex python-scikit-learn python-scipy python-torchvision-cuda python-tqdm python-  
xmldict make gcc cmake unzip python-setuptools
```

2. make dirs

```
mkdir ~/cat ~/ssddata ~/hydra_saves ~/ssddata/anchors
```

3. setup python stuff

```
mkdir ~/catvenv/; python3 -m venv ${PWD}/catvenv --system-site-packages;
```

```
source ~/catvenv/bin/activate; pip install easydict editdistance wandb
```

```
cd ~/cat; git clone https://github.com/lancercat/make_envNG.git
```

```
cd make_envNG/ ; sh pylcs.sh ;
```

```
unzip pytorch_scatter-laser.zip ; cd pytorch_scatter-2.1.2/; python setup.py install
```

4. unzip data and model

```
cd ~/cat/wna/ sh unzip.sh ${DOWNLOADPATH} # Note the script is not yet there. Give me some  
time to test it...
```

5. clone the code

```
cd ~/cat; git clone https://github.com/lancercat/wna.git
```

6. stop and check:

```
(catvenv) [lancercat@TESTMEOW ~]$ ls cat  
make_envNG wna  
(catvenv) [lancercat@TESTMEOW ~]$ ls hydra_saves  
aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32  
aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_mjst_b32  
aroute_nd_only-v6S-tiny-AAF  
aroute_nd_only-v6S-tiny-AAF-01E  
aroute_nd_only-v6S-tiny-AAF-01E-run2  
aroute_nd_only-v6S-tiny-AAF-run2  
aroute_nd_only-v6S-tiny-nedmix-AAF  
aroute_nd_only-v6S-tiny-nedmix-AAF-ohem01  
aroute_nd_only-v6S-tiny-nedmix-AAF-ohem01E  
aroute_nd_only-v6S-tiny-nedmix-AAF-ohem01E-run2  
aroute_nd_only-v6S-tiny-nedmix-AAF-ohem01E-run2  
aroute_nd_only-v6S-tiny-nedmix-AAF-run2  
(catvenv) [lancercat@TESTMEOW ~]$ ls ssddata/  
anchors          ctwch          CVPR2016      IC13_1015      mltrchlat_seen  mltrkr_hori    rctwtrdb_seen_NG  
artdb_seen       ctwdb_seen     dicts         IIIT5k_3000    mltrchlat_seen_NG  NIPS2014      SVT  
artdb_seen_NG    ctwdb_seen_NG  dictsv2       lsvtdb_seen    mltrjp_hori      pami_ch_fsl_hwdb  
athenaNG         CUTE80        IC03_867      lsvtdb_seen_NG mltrjp_hv        rctwtrdb_seen
```



Reproducing ablative studies

1. run `ablative.py` (in a screen session as it takes some time):

```
python ablative.py 2>&1 | tee all.log
```

(our log is uploaded to github)

2. After the ablative experiments are finished (usually takes like a dozen hours on an GTX 1650), run `ablative2table.py` to compute mean and standard deviation:

```
/home/lasercat/catvenv/bin/python3.13 /home/lasercat/cat/wna/ablative2table.py
\newcommand{\LPAoBASEoJPNHVo6ZSLoLAoAVG}{40.97}
\newcommand{\LPAoBASEoJPNHVo6ZSLoLAoSTD}{1.02}
\newcommand{\LPAoW0ARoUeJPNHVo6ZSLoLAoAVG}{42.11}
\newcommand{\LPAoW0ARoUeJPNHVo6ZSLoLAoSTD}{0.51}
\newcommand{\LPAoPGoLoJPNHVo6ZSLoLAoAVG}{41.49}
\newcommand{\LPAoPGoLoJPNHVo6ZSLoLAoSTD}{1.01}
\newcommand{\LPAoPGoLoJPNHVo6ZSLoLAoAVG}{43.09}
\newcommand{\LPAoPGoLoJPNHVo6ZSLoLAoSTD}{0.33}
\newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoAVG}{39.66}
\newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoSTD}{0.36}
\newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoAVG}{43.17}
\newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoSTD}{0.39}
\newcommand{\LPAoARoLoJPNHVo6ZSLoLAoAVG}{41.88}
\newcommand{\LPAoARoLoJPNHVo6ZSLoLAoSTD}{0.59}
\newcommand{\LPAoARoLoJPNHVo6ZSLoLAoAVG}{43.90}
\newcommand{\LPAoARoLoJPNHVo6ZSLoLAoSTD}{0.86}
\newcommand{\LPAoW0oHEMoJPNHVo6ZSLoLAoAVG}{42.05}
\newcommand{\LPAoW0oHEMoJPNHVo6ZSLoLAoSTD}{0.25}
\newcommand{\LPAoJPNHVo6ZSLoLAoAVG}{45.14}
\newcommand{\LPAoJPNHVo6ZSLoLAoSTD}{0.35}
\newcommand{\LPAoOHEMoJPNHVo6ZSLoLAoAVG}{44.53}
\newcommand{\LPAoOHEMoJPNHVo6ZSLoLAoSTD}{0.31}
-----
Process finished with exit code 0
```

3. save the output text as a txt file, say `reprod.txt`

(our log is can be found in this github repo as `reprod.txt`)

4. diff them:

```
diff reprod.txt paperref.txt --color
```

Expect the results to be a bit different here and there due to float error between different implementations of operators, which can be caused by different torch version, gpu structure, vram, etc (yes, torch[1] and CUDNN[2] may choose different backend on different hardware)

[1] <https://discuss.pytorch.org/t/different-machines-different-results/100126>

[2] <https://docs.nvidia.com/deeplearning/cudnn/backend/latest/developer/core-concepts.html>

```
(catvenv) [lasercat@TESTMEOW wna]$ diff reprod.txt paperref.txt --color
2c2
< \newcommand{\LPAoBASEoJPNHVo6ZSLoLAoSTD}{1.02}
---
> \newcommand{\LPAoBASEoJPNHVo6ZSLoLAoSTD}{1.03}
7c7
< \newcommand{\LPAoPGoLoJPNHVo6ZSLoLAoAVG}{43.09}
---
> \newcommand{\LPAoPGoLoJPNHVo6ZSLoLAoAVG}{43.07}
9,10c9,10
< \newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoAVG}{39.66}
< \newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoSTD}{0.36}
---
> \newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoAVG}{39.65}
> \newcommand{\LPAoPGoNoJPNHVo6ZSLoLAoSTD}{0.35}
13c13
< \newcommand{\LPAoARoLoJPNHVo6ZSLoLAoAVG}{41.88}
---
> \newcommand{\LPAoARoLoJPNHVo6ZSLoLAoAVG}{41.89}
18,20c18,20
< \newcommand{\LPAoW0oHEMoJPNHVo6ZSLoLAoSTD}{0.25}
< \newcommand{\LPAoJPNHVo6ZSLoLAoAVG}{45.14}
< \newcommand{\LPAoJPNHVo6ZSLoLAoSTD}{0.35}
---
> \newcommand{\LPAoW0oHEMoJPNHVo6ZSLoLAoSTD}{0.24}
> \newcommand{\LPAoJPNHVo6ZSLoLAoAVG}{45.15}
> \newcommand{\LPAoJPNHVo6ZSLoLAoSTD}{0.36}
22a23,24
```



run object310-rel/project310_v6SF_stability-re/aroute_nd_only-v6S-tiny-nedmix-AAF-ohem01E

Let's map them to the table

Note the performance differs a bit on this 1650, but not much (utilization btw)



Reproducing Large Model

Open-set

Run object310-rel/XL/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/osocr_benchall.py

```
/home/lasercat/cat/ana/ana_env/ana_framework_00/modules/concat_env_dev.py:67: UserWarning: To copy construct from a tensor, it is recommended to use sourceTensor.detach().clone() or sourceTensor.detach().clone().requires_grad_(True), rather than torch.tensor(sourceTensor).
  img=torch.stack([torch.tensor(i, dtype=this.get_type()) for i in imgList]).permute(0,3,1,2).contiguous().to(this.mean_data.device)-this.mean;
WARN: Corrupted image for 5871
Date: 2025-06-12 16:06:15.569554 ,TEST: KR-KR-GZSL ,Epoch: 0 ,Iter: 0 ,Total: 5170 ,ACR: 0.23965183752417796 ,Lenpred_ACR: 0.7253384912959381 ,FPS: 93.31770637168638
WARN: Corrupted image for 5875
Date: 2025-06-12 16:07:21.041607 ,TEST: JPNHV-JPNHV-GZSL ,Epoch: 0 ,Iter: 0 ,Total: 5074 ,ACR: 0.461568782026015 ,Lenpred_ACR: 0.8303113914071738 ,FPS: 91.47280815247775
WARN: Corrupted image for 5875
('Date': datetime.datetime(2025, 6, 12, 16, 0, 40, 4023), 'TEST': 'JPNHV-JPNHV-OSR', 'Epoch': 0, 'Iter': 0, 'Total': 5074.0, 'KACR': 0.7764070932922128, 'R': 0.7151178183743712, 'P': 0.954416961138742, 'F': 0.8176176782208696)
WARN: Corrupted image for 5875
('Date': datetime.datetime(2025, 6, 12, 16, 9, 11, 852653), 'TEST': 'JPNHV-JPNHV-GOSR', 'Epoch': 0, 'Iter': 0, 'Total': 5074.0, 'KACR': 0.7122658183103571, 'R': 0.6298440979955456, 'P': 0.8815461346633416, 'F': 0.7347362951415952)
WARN: Corrupted image for 5875
('Date': datetime.datetime(2025, 6, 12, 16, 9, 386266), 'TEST': 'JPNHV-JPNHV-OSTR', 'Epoch': 0, 'Iter': 0, 'Total': 5074.0, 'KACR': 0.738936256976452, 'R': 0.8050555342780544, 'P': 0.9239560439560439, 'F': 0.860417519433075)
Date: 2025-06-12 16:10:48.242145 ,TEST: JPN-JPN-GZSL ,Epoch: 0 ,Iter: 0 ,Total: 4809 ,ACR: 0.4804190571214767 ,Lenpred_ACR: 0.823896233474682 ,FPS: 98.4153275062363
('Date': datetime.datetime(2025, 6, 12, 16, 11, 28, 836917), 'TEST': 'JPN-JPN-OSR', 'Epoch': 0, 'Iter': 0, 'Total': 4809.0, 'KACR': 0.809720785938841, 'R': 0.7176199868507561, 'P': 0.9620978404858317, 'F': 0.8228674072679366)
('Date': datetime.datetime(2025, 6, 12, 16, 12, 9, 855949), 'TEST': 'JPN-JPN-GOSR', 'Epoch': 0, 'Iter': 0, 'Total': 4809.0, 'KACR': 0.763152227213496, 'R': 0.6254567981234568, 'P': 0.9076797385620915, 'F': 0.7391882908866937)
('Date': datetime.datetime(2025, 6, 12, 16, 12, 50, 407182), 'TEST': 'JPN-JPN-OSTR', 'Epoch': 0, 'Iter': 0, 'Total': 4809.0, 'KACR': 0.7735355648535565, 'R': 0.8063900810681927, 'P': 0.9489337822671156, 'F': 0.8718741943799947)
wandb:
wandb: You can sync this run to the cloud by running:
wandb: wandb sync /home/lasercat/hydra_logs/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/watch_and_control/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/wandb/offline-run-20250612_160516-78pek5ea
wandb: Find logs at: .../hydra_logs/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/watch_and_control/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/wandb/offline-run-20250612_160516-78pek5ea/logs
Process finished with exit code 0
```

Let's map them to the table

Split	Registered	Out-of-Set	Name	LA	Recall	Precision	FM
GZSL (Hori.)	Unique Kanji	∅	OSOCR-Large [4]	30.83	—	—	—
	Shared Kanji,		OpenCCD-Large [23]	41.31	—	—	—
	Kana, Latin,		OpenSAVR-XL [34]	42.58	—	—	—
			MOoSE-XL* [7]	39.56	—	—	—
			CFOR-XL [37]	44.47	—	—	—

Date: 2025-06-12 16:10:48.242145 ,TEST: JPN-JPN-GZSL ,Epoch: 0 ,Iter: 0 ,Total: 4809 ,ACR: 0.4804190571214767 ,Lenpred_ACR: 0.823896233474682 ,FPS: 98.4153275062363

			WnA-S-XL (Ours)*	48.02	—	—	—
OSTR (Hori.)	Shared Kanji,	Kana Latin	OSOCR-Large [4]	58.57	24.46	93.78	38.80
	Unique Kanji		OpenSAVR-XL [34]	72.33	72.96	92.62	81.62
			MOoSE-XL* [7]	64.80	80.49	89.12	84.50
			CFOR [37]	71.80	86.36	89.52	87.91

'TEST': 'JPN-JPN-OSTR', 'Epoch': 0, 'Iter': 0, 'Total': 4809.0, 'KACR': 0.7735355648535565, 'R': 0.8063900810681927, 'P': 0.9489337822671156, 'F': 0.8718741943799947

			WnA-S-XL(Ours)*	77.35	80.68	94.89	87.21
--	--	--	-----------------	-------	-------	-------	-------

GZSL	Shared Kanji		MOoSE-XL	37.39	—	—	—
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: 2025-06-12 16:07:21.041607 ,TEST: JPNHV-JPNHV-GZSL ,Epoch: 0 ,Iter: 0 ,Total: 5074 ,ACR: 0.461568782026015 ,Lenpred_ACR: 0.8303113914071738 ,FPS: 91.47280815247775

	Latin, Kana		WnA-S-XL(Ours)	46.14	—	—	—
--	-------------	--	----------------	-------	---	---	---

OSR	Shared Kanji	Unique Kanji	MOoSE-XL	75.56	74.05	95.79	83.53
-----	--------------	--------------	----------	-------	-------	-------	-------

ST': 'JPNHV-JPNHV-OSR', 'Epoch': 0, 'Iter': 0, 'Total': 5074.0, 'KACR': 0.7764070932922128, 'R': 0.7151178183743712, 'P': 0.954416961138742, 'F': 0.8176176782208696)

			WnA-S-XL(Ours)	77.64	71.45	95.44	81.72
--	--	--	----------------	-------	-------	-------	-------

GOSR	Shared Kanji	Kana	MOoSE-XL	59.81	63.83	81.89	71.74
------	--------------	------	----------	-------	-------	-------	-------

': 'JPNHV-JPNHV-GOSR', 'Epoch': 0, 'Iter': 0, 'Total': 5074.0, 'KACR': 0.7122658183103571, 'R': 0.6298440979955456, 'P': 0.8815461346633416, 'F': 0.7347362951415952)

	Latin		WnA-S-XL(Ours)	71.22	62.89	88.08	73.38
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OSTR	Shared Kanji	Latin	MOoSE-XL	61.75	80.01	88.18	83.90
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'JPNHV-JPNHV-OSTR', 'Epoch': 0, 'Iter': 0, 'Total': 5074.0, 'KACR': 0.738936256976452, 'R': 0.8050555342780544, 'P': 0.9239560439560439, 'F': 0.860417519433075)

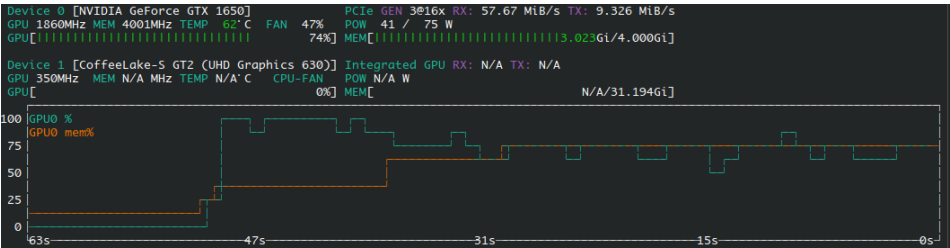
			WnA-S-XL(Ours)	73.89	80.50	92.39	86.04
--	--	--	----------------	-------	-------	-------	-------

GZSL	Hangul	∅	CFOR-XL [37]	22.14	—	—	—
------	--------	---	--------------	-------	---	---	---

TEST: KR-KR-GZSL ,Epoch: 0 ,Iter: 0 ,Total: 5170 ,ACR: 0.23965183752417796 ,Lenpred_ACR: 0.7253384912959381 ,FPS: 93.33770637168638

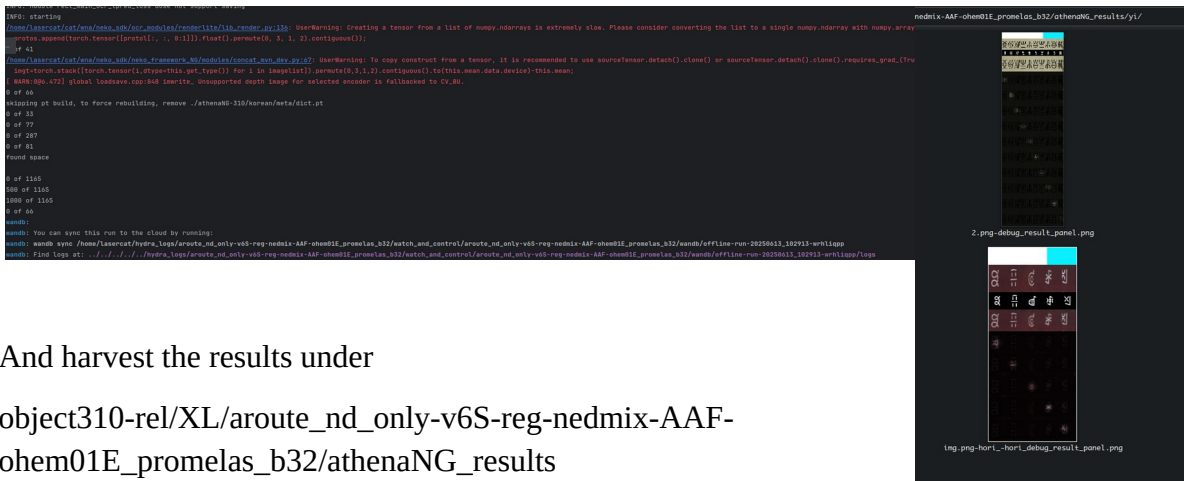
			WnA-S-XL (Ours)	24.00	—	—	—
--	--	--	-----------------	-------	---	---	---

Note the performance differs a bit on this 1650, but not much (utilization btw)



Reproducing Fig 1& Inference on your own data

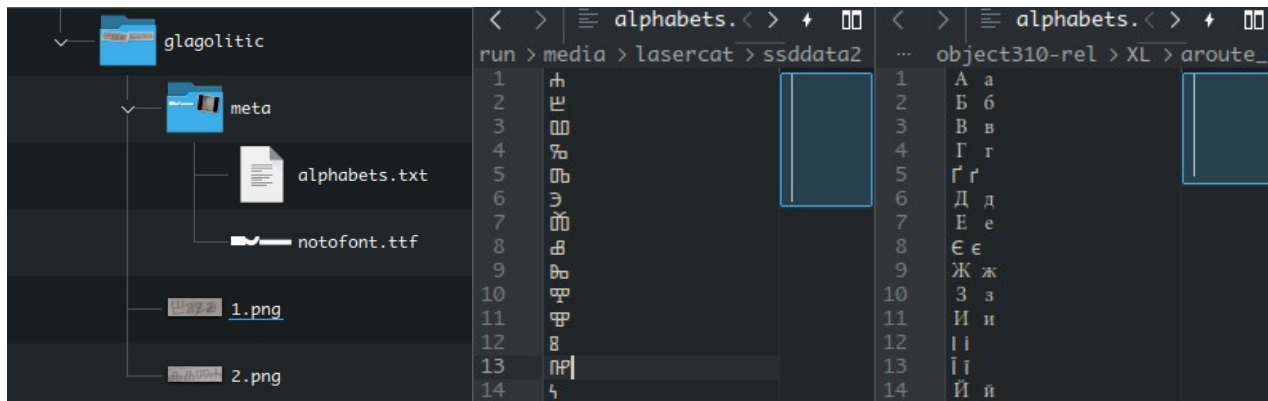
Run object310-rel/XL/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/athena.py



And harvest the results under

object310-rel/XL/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/athenaNG_results

For you own data to inference, you need to prepare the meta/alphabets.txt, the meta/notofont.ttf, and images.

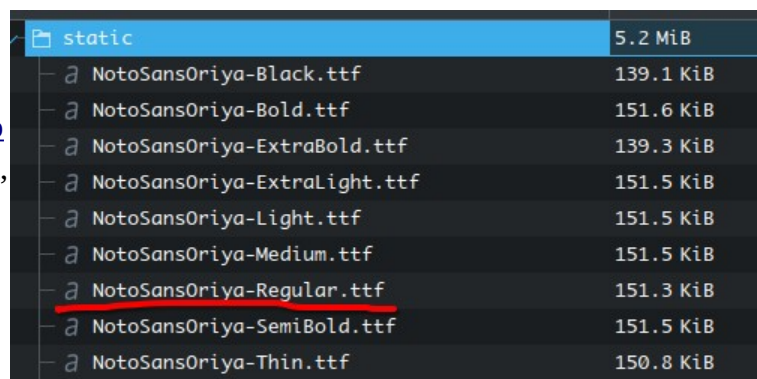


The meta/alphabets.txt contains all alphabets, each a line. If an alphabet has more than one cases, split them with space.

For the notofont.ttf, you search for the font here: <https://fonts.google.com/noto>
Download it, extract the regular variant, rename it to notofont.ttf, and add it to the folder.

Close-set

Run object310-rel/XL/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_mjst_b32/test.py



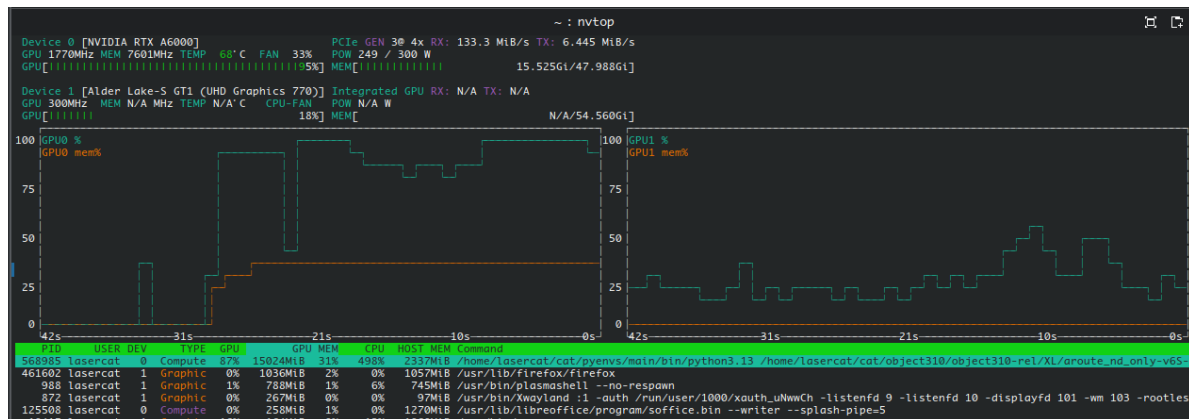
Training from Scratch

Run train.py under either of the method folder. For example the XL model:

object310-rel/XL/aroute_nd_only-v6S-reg-nedmix-AAF-ohem01E_promelas_b32/train.py

```
↑ INFO: let me remind you that queue contents can not be restored for now
↓ INFO: Module hori_main_ocr_cls_loss dose not support saving
↶ INFO: Module hori_main_ocr_lpred_loss dose not support saving
↷ INFO: Module vert_main_ocr_cls_loss dose not support saving
↶ INFO: Module vert_main_ocr_lpred_loss dose not support saving
↷ INFO: Module rect_main_ocr_cls_loss dose not support saving
↶ INFO: Module rect_main_ocr_lpred_loss dose not support saving
↷ WARN: detected undefined queue: dq defining
WARN: detected undefined queue: preaug_dq defining
INFO: starting
/home/lasercat/cat/object310/neko_sdk/neko_framework_NG/modules/concat_mvn_dev.py:67: UserWarning: To copy construct from a tensor, it is recommend
imgt=torch.stack([torch.tensor(i,dtype=this.get_type()) for i in imagelist]).permute(0,3,1,2).contiguous().to(this.mean.data.device)-this.mean;
{'images': {}, 'texts': {}, 'routing': {'stat': {'hori_': 44, 'rect_': 48, 'vert_': 28}, 'routing_table': '[[np.int64(0), np.int64(2)], [np.int64(2),
/home/lasercat/cat/object310/neko_sdk/neko_framework_NG/modules/concat_mvn_dev.py:67: UserWarning: To copy construct from a tensor, it is recommend
imgt=torch.stack([torch.tensor(i,dtype=this.get_type()) for i in imagelist]).permute(0,3,1,2).contiguous().to(this.mean.data.device)-this.mean;
{'images': {}, 'texts': {}, 'routing': {'stat': {'rect_': 48, 'hori_': 39, 'vert_': 34}, 'routing_table': '[[np.int64(2), np.int64(0)], [np.int64(0),
{'images': {}, 'texts': {}, 'routing': {'stat': {'hori_': 44, 'rect_': 53, 'vert_': 29}, 'routing_table': '[[np.int64(0)], [np.int64(0)], [np.int64(0),
{'images': {}, 'texts': {}, 'routing': {'stat': {'hori_': 40, 'rect_': 51, 'vert_': 32}, 'routing_table': '[[np.int64(0), np.int64(2)], [np.int64(0),
{'images': {}, 'texts': {}, 'routing': {'stat': {'hori_': 41, 'rect_': 45, 'vert_': 33}, 'routing_table': '[[np.int64(0), np.int64(2)], [np.int64(0),
{'images': {}, 'texts': {}, 'routing': {'stat': {'hori_': 41, 'rect_': 49, 'vert_': 32}, 'routing_table': '[[np.int64(0), np.int64(2)], [np.int64(0),
|
```

And watch it cook. Utilization BTW



If you want to train with your own data, please try to follow the instruction from the vanilla osocr paper, the lmdbs are fully compatible.

The newly added dicts_v2/lang/vismeta.pt builders can be reverse engineered from the athena scripts. Writing this manual takes too long already so I am not going to write an extensive document on this now... GLHF.



That's it

If anything is buggy, doesn't work, or you just want to chat, open an issue or contact us

Chang: lasercat@gmx.us; chang.liu@ltu.se

Elisa: elisa.barney@ltu.se

BTW... Since manuls are spelled like manuals, so you will see a manul at the end of each section as a end-of-section icon.

See ya && GLHF

